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Platform development for drought tolerance evaluation of wheat in France

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Abstract

Introduction :
Drought is projected to be an increasing problem for wheat in France. We provide some key figures on current and projected drought stress in France. Evaluating drought tolerance is a complex task. Climate variability can lead to very different drought stress conditions in field experiments. The importance of genotype by environment interactions under drought also requires that trial environments be related to the types of drought prevalent in each target population of environments. We present the framework developed at Arvalis to deal with these complex interactions.

Materials and methods :
- Two dedicated platforms have been developed to carry out genotype evaluations for association genetics panels. A field platform has been in operation for 5 years. Tools developed on the platform include a microplot scale soil characterization and the PhenoMobile automated phenotyping system. The second, under construction, is PhenoField, including automated rain-out shelters and phenotyping systems.
- A network of field trials is run on a subset of varieties to identify trait x environment interactions for drought response.
- Climatological analysis using a water balance model is carried out across France.

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Results :

- The diversity of drought stress intensities over 5 years in the field platform is presented and compared to the climatological analysis of drought in France.
- The correlation of traits, for example Carbon Isotope Discrimination, to perform in diverse drought environments is assessed throughout the field network.
- The use of microplot scale soil characterization significantly improves precision and heritability on our panel evaluation.
- An update on the development of PhenoMobile and PhenoField systems is given.

Discussion :

- Drought tolerance evaluation requires an integration of multiple tools. We combine well characterized sites with high throughput capacities to trial networks and climatological analysis to extrapolate results.

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Keywords:

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